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Biology 30
Aug., 1969

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HIGH SCHOOL AND UNIVERSITY MATRICULATION

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DEPARTMENTAL EXAMINATIONS, 1969

AUGUST

BIOLOGY 30

Time — 2 hours.

DO NOT SPEND TOO MUCH TIME ON ANY ONE QUESTION.
READ THE PAPER CAREFULLY.

Total Possible Mark — 105.

Questions 1 to 105 are multiple choice questions, valued at 1 mark each.
Candidates should attempt to answer all questions.

Record answers on the answer sheet provided using an ordinary HB pencil.

To ensure accuracy in the handling of your examination papers, the following sections on your ANSWER SHEET MUST BE COMPLETED.

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in the example below.

EXAMPLE

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1. Which of the followi
g sugar?

A. sucrose
B. fructose
C. glucose
D. maltose

2. Fats are special kinds of

A. acids
B. alcohols
C. carbohydrates
D. esters

3. An important function of mitosis is to

A. form haploid daughter cells
B. duplicate the mother cell's chromosomes
C. distribute cytoplasm to the daughter cells
D. increase the size of the daughter cells

4. Systems in which particles do not readily go into solution or settle out are called

A. ionic
B. colloidal
C. dispersed
D. stable

5. Blood type in mammals is determined by the

A. kind of agglutinins present
B. quantity of protective substances in plasma
C. kind of agglutinogens present
D. kind of enzymes present

6. Which of the following is an example of chlorophyll disintegrating in the presence of light?

A. the bright colored leaves seen in the fall
? B. the non-geen color of the woody portion of a plant
C. the occasional presence of albino plants
D. all of these are examples of this phenomenon

7. Muscle fatigue is thought to be the consequence of

A. lack of sufficient ATP molecules
B. paying off the oxygen debt
C. poisons in the blood stream
D. lactic acid accumulation

8. Viruses are known to lack ribosomes. This explains why they

A. cause disease
? B. have no enzyme systems
C. are so small
D. contain no hereditary material

9. Glycogen differs from plant starch primarily because of

? A. its presence in animal systems
B. the way it is synthesized
C. its molecular size and structure
D. the different atoms present

10. Molecules tend to move away from a region where they are highly concentrated. This is the principle of

A. Brownian movement
B. thermodynamics
C. diffusion
D. osmosis

11. Fermentation

A. occurs mainly in Metazoa
B. requires carbon dioxide
C. is a form of aerobic respiration
D. does not require oxygen

12. Grana are

A. specialized plant cells
B. small quantities of starch in a plant cell
? C. chloroplasts
D. chlorophyll-containing bodies

13. The spreading of a new gene depends directly on whether

A. it is advantageous or disadvantageous
? B. it is needed for the survival of the species
C. the individuals with the gene have more offspring than those without the gene
D. the organism carrying it is well adapted to its environment

14. In human beings an individual might have 47 chromosomes in each somatic cell. Since the normal chromosome number is 46, the abnormality may be explained by

[✓ A.] incomplete separation of chromosomes in mitosis
B. the formation of a gamete with 24 chromosomes
C. an ancestral mutation
D. the lack of centrioles

15. In photosynthesis, the dark reaction involves

A. hydrogen and carbon dioxide
B. the formation of ATP
C. the photolysis of water
D. glycolysis

16. The substance NOT directly involved with the release of energy in a cell is

A. water
B. phosphate
C. nitrogen
D. oxygen

17. Genetic drift is due to

A. the extreme mobility of genes
B. Hardy-Weinberg equilibria
C. the odd individual moving to different population
D. chance variations in small groups

18. Which substance turns blue-black when tested with iodine?

A. sucrose
B. fructose
C. glycogen
[✓ D.] starch

19. Chemical union of simple molecules into more complex molecules with water as a by-product is termed

A. enzymatic synthesis
B. dehydration
C. dehydrogenation
[✓ D.] dehydration synthesis

20. In some mammals, such as the reindeer, when the environmental temperatures are very low, the body extremities approach the freezing point. These animals have a heat-conserving device. This device is an example of

[✓ A.] an evolutionary adaptation of a control system
B. a reflex control system
C. a structural abnormality in the species
D. a functional abnormality in the species

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21. Fission, budding, fragmentation and sparulation are similar processes in that

A. the parent splits into two equal parts
B. a piece of the parent breaks free and forms another organism
C. all forms are accompanied by meiosis
D. gametes are not involved

22. The cyclic fixation of CO_2 results in phosphoglyceraldehyde which is usually

A. accumulated in the grana
B. exported to other cells
C. converted to ATP
D. converted to glucose

23. The transfer of chemical energy from glucose molecules to ATP molecules requires

[✓ A. phosphorylation and heating]
B. heating and molecular rearrangement
C. molecular rearrangement and phosphorylation
D. phosphorylation and acidification

24. The mucus covering a frog's skin is necessary to

A. keep its skin in a smooth condition
B. help gases diffuse through the skin
C. protect the frog when it is buried in the mud
D. protect the frog from its enemies

25. Which of the following statements does NOT apply to the chemical makeup of DNA?

A. It is a macromolecule.
B. It consists of nucleic acids.
C. It is a double helix with cross ties.
D. It is structured very much like an enzyme.

26. An infant blinks when a loud noise is made nearby. This is an example of

A. an innate reflex action
B. a learned reflex action
C. a conditioned reflex action
D. a stimulus ⟶ thought ⟶ reflex action

27. An extraembryonic membrane that immediately surrounds the embryo is called the

A. chorion
B. amnion
C. allantois
D. yolk sac

28. A slice of potato placed in cold water becomes firm after several hours because

A. water has passed from the surrounding medium into the potato cells to produce turgor
B. water has passed from the cells of the potato into the surrounding water
C. there is an additional formation of cellulose in the cell walls
D. plant tissues become more rigid at low temperatures

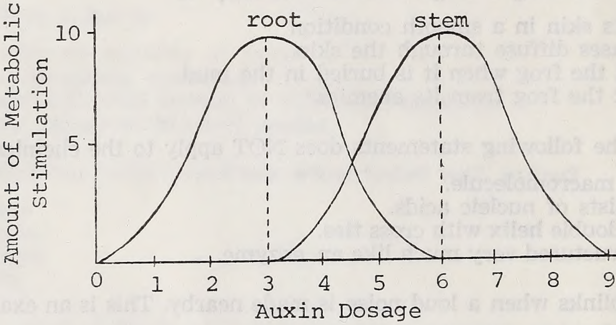
29. A frame of reference for an experiment may be established by

A. formulating hypotheses
B. drawing conclusions
C. referring to authorities
D. using a control

30. Scientists generally agree that organisms have evolved from a marine habitat to a terrestrial habitat. If the above statement is correct, which organism is likely the most primitive of those listed?

A. whale
B. seal
C. turtle
D. frog

Use the graph below to answer questions 31 and 32.



31. According to the graph, what adaptive function might auxins have in a plant?

A. When the root is growing rapidly, the stem is not.
B. Roots and stems can grow simultaneously and rapidly.
C. When one portion of a plant gets large, it ceases growing and lets the other parts catch up.
D. Roots absorb auxins from the soil and pass them to the stem.

32. According to the graph, 6 units of auxin would

A. inhibit stem and root growth
B. produce roots on the stem
C. inhibit the root and stimulate the stem
D. stimulate greater growth in both roots and stems

---

33. The advantage of polar body formation in oögenesis is that it

A. inhibits the production of more than one egg
B. gets rid of chromosomes but allows maximum egg size
C. discards useless chromosomes
D. allows for the complete segregation of one set of chromosomes

34. The primary source of energy for most organisms is

A. PGAL
B. light
C. glucose
D. starch

35. Analysis has revealed that blood plasma contains 20 times more sodium than potassium, whereas a red cell floating in the plasma contains 20 times more potassium than sodium. To account for this concentration of potassium in the red cells, an animal physiologist would probably say that it was due to

A. ordinary diffusion
B. some type of passive osmotic device
C. some method of active transport
D. a metabolic activity resembling respiration

36. Energy liberated in the respiration of glucose is ultimately stored

A. in the form of ATP
B. as PGAL
C. as glycogen
D. in muscle tissue

37. The great importance of the phosphate group in biological systems is due to its

A. bonding capabilities
B. oxygen content
C. presence in ATP
D. abundance in nature

38. In the Drosophila life cycle, meiosis occurs

A. during spore formation
B. during gamete formation
C. after zygote formation
D. during copulation

39. In aerobic respiration the necessary sequential order of hydrogen transfer is

A. DPN, flavoprotein, cytochromes, oxygen
B. flavoprotein, DPN or TPN, cytochromes, oxygen
C. TPN, flavoprotein, cytochromes, water
D. DPN, pyruvic acid, flavoprotein, cytochromes, oxygen

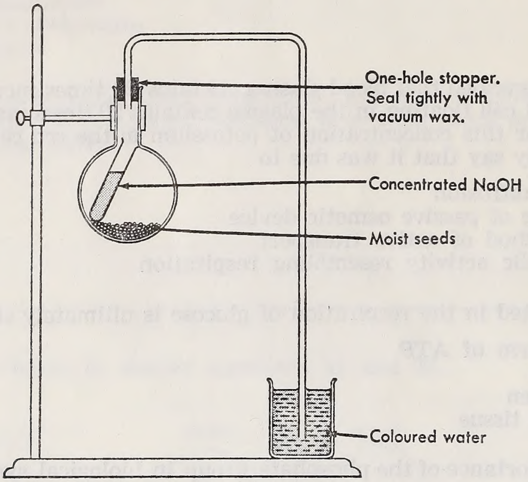
40. In cellular respiration, the greatest amount of energy is produced by

A. glycolisis
B. the conversion of pyruvic to acetic acid
C. hydrogen transfer
D. the citric acid cycle

41. If one used a stethoscope and a sphygmomanometer, he would likely be measuring

A. pulse rate
[✓ B.] blood pressure
C. heart beat
D. blood count

Use the diagram below to answer questions 42 and 43.



42. The NaOH in the above experiment is used to

A. react with the water produced
B. react with the O_2 produced
C. react with the CO_2 produced
D. sterilize the seeds

43. How many calories would be released per gram of glucose-equivalent in the seeds?

A. .14
B. .28
C. 3.8
D. 7.6

---

44. The gland which produces both an enzyme and a hormone is the

A. pancreas
B. thyroid
C. liver
D. pituitary

45. In preparation for energy release, glucose becomes more chemically active by

A. acquiring a high-energy phosphate unit from ATP
B. acquiring a low-energy phosphate unit from ATP
C. combining its molecules to form polysaccharides
D. adding energy to ADP

46. Controls exist within endocrine systems because

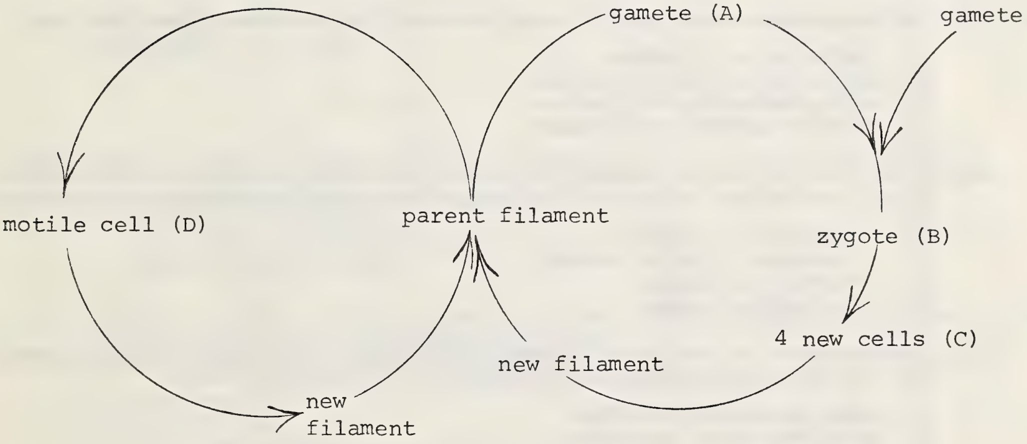
A. the glands are hormone producers
B. the hormones are stimulating
C. some glands are affected by output of others
D. of the action of the central nervous system

In questions 47 and 48, choose the word that does NOT belong in each list.

47. A. $HbCO_2$
B. HbO_2
C. $HbCO$
D. $HbHCO_3$

48. A. Beriberi
B. Diabetes
C. Pellagra
D. Scurvy

The following chart shows the life cycle of a primitive plant. Use the chart below to answer questions 49 and 50. (Each choice may be used more than once.)



49. What stage represents haploid cells formed from a diploid cell?

50. Which stage is formed from the fusion of two nuclei?

---

51. There is a general correlation between the amount of yolk in an egg and the nutritional pattern of the developing embryo. This relationship is best illustrated by comparing eggs of

A. sparrows and frogs
B. dogs and geese
C. sparrows and geese
D. turtles and frogs

52. Pyruvic acid metabolism requires the presence of

A. nicotinic acid
B. iron compounds
C. riboflavin
D. thiamine

53. Materials such as enzymes, inorganic materials or genes function in living systems primarily as

A. receptors
B. transporters
C. effectors
D. modulators

---

54. Sessile aquatic invertebrates such as sponges, corals, oysters and numerous others without exception have motile larvae which swim or float, thus serving the function of dispersal. These larvae are thus analogous to what element in the plant kingdom?

A. seeds
B. pollen
C. flowers
D. gametes

55. The oxygen liberated by plants in the process of photosynthesis comes from the

A. disintegration of glucose
B. disintegration of carbon dioxide
C. water absorbed by the plant
D. oxygen absorbed in respiration

56. In terms of an overall summary of photosynthesis the production of one molecule of PGAL involves the uptake of 6 molecules of water with nearly simultaneous release of

A. 6 molecules of oxygen
B. 3 molecules of carbon dioxide
C. 1 molecule of glucose
D. 3 molecules of water

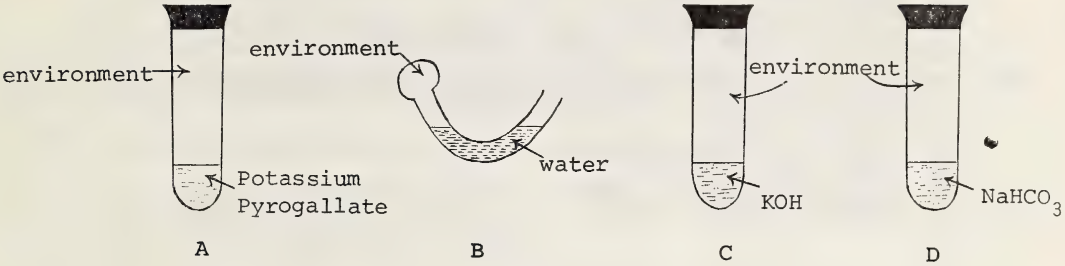
57. Children are often told not to eat candy before meals because it will ruin their appetites. The best scientific explanation for the effect on the appetite is that

A. candy causes tooth cavities
B. the satiety center is stimulated
C. the gastric juices of the stomach may become used up
D. the amino acid level of the blood is increased

58. In bacteria, the antibiotics streptomycin, neomycin, viomycin and others are thought to combine with the ribosomes and thus disrupt their normal function. In other words, these antibiotics destroy bacteria by

A. preventing their protein synthesis
B. increasing their respiration to an abnormal rate
C. inhibiting their photosynthetic activity
D. preventing them from reproducing normally

For questions 59 and 60 use the following diagram as choices.



59. Which apparatus is most suitable to carry out an experiment in which a CO_2-rich environment is required?

60. Which apparatus is most suitable to carry out an experiment in which an O_2-free atmosphere is required?

---

61. Phase reversal in colloids is directly affected by all of the following EXCEPT

A. temperature change
B. volume of soluble salts
C. electrical charge of particles
D. volume of insoluble salts

62. A sample of milk is added to three test tubes. Rennin is added to the first, boiled rennin to the second, and nothing to the third.
After incubation, coagulation will be seen in

A. test tube 1
B. test tube 2
C. test tubes 1 and 3
D. test tubes 2 and 3

A student is carrying out a series of tests on an unknown solution.
(The same solution is used for questions 63, 64, 65 and 66.)

63. If the student added oxalic acid and no change occurred, he could conclude that there were NO

A. copper ions present
B. chloride ions present
C. calcium ions present
D. sulfate ions present

64. If potassium ferrocyanide were added and a precipitate formed, he could conclude

A. ferric or cupric ions are present
B. carbonate or bicarbonate is present
C. sulphate is present
D. phosphate is present

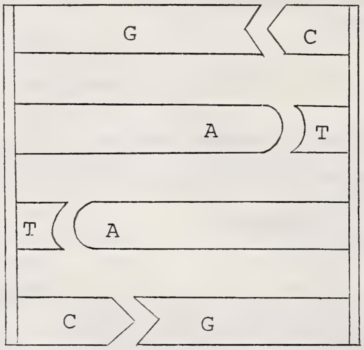
65. If silver nitrate were added and a precipitate occurred, he could conclude that

A. either chloride or phosphate ions are present
B. copper ions are present
C. sulphate ions are present
D. either carbonate or bicarbonate ions are present

66. If the precipitate from the reaction in 65 above were treated with nitric acid and if the precipitate disappeared, he could conclude that

A. chloride ions were present
B. sulfate ions were present
C. bicarbonate ions were present
D. phosphate ions were present

Questions 67, 68 and 69 are based on the diagram shown below.



67. This diagram represents

A. a granum
B. a RNA molecule
C. a DNA molecule
D. an enzyme

68. Which of the following applies most accurately to the substance represented by the diagram?

A. It is an energy-releasing material in the cytoplasm.
B. It is found in chromosomes.
C. It is the protein material of which chromosomes are made.
D. It is found in ribosomes.

69. The arrangement of the letters A, G, C and T in the diagram represents

A. high energy packets
B. genes
C. enzymes
D. a chemical code

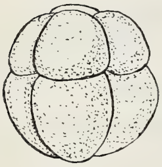
70. On the continent of Australia a number of unique animals may be found including a "wingless" bird, several pouch-bearing animals and an egg-laying mammal. These strange animals are most likely a result of

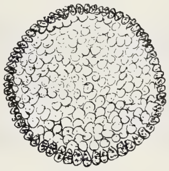
A. the elimination of more advanced forms through natural selection
B. insufficient time to acquire characteristics of our more common animals
C. isolation of populations over a long period of time
D. no mutations having occurred in the genes

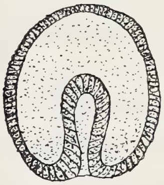
71. In the life cycle of the moss, reduction division occurs

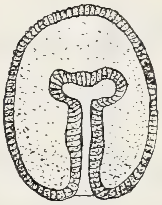
A. just prior to zygote development
B. as the gametes are produced
C. at the time of spore germination
D. as the spores are being produced

72. Which one of the diagrams below BEST shows the blastula stage?


A.


B.


C.


D.

73. With reference to the exchange and transport of materials in the body, capillaries are a vital part of circulatory systems because

A. blood pressure is controlled in that area
B. they bring blood to the body surface for cooling
C. of the homeostatic control they exert in purifying the blood
D. this is the only region where materials enter and leave the blood stream

74. Although lipase is found in gastric juice, little lipase-activated digestion takes place in the stomach. The enzyme becomes active when moved to the duodenum because

A. it is secreted in an inactive form
B. it mainly acts in an acid medium
C. it mainly acts in an alkaline medium
D. the lipids have not yet become emulsified

75. The scum that forms on boiled milk is an example of

A. a polypeptide
B. an interfacial membrane
C. a protoplasmic system
D. the denaturation of nucleoproteins

Use the following information to answer questions 76, 77, 78 and 79.

In tomatoes, T is dominant for tallness; t = short;
R is dominant for red color; r = white.

76. What is the phenotype of a tomato TtRr?

A. tall red
B. tall white
C. short red
D. short white

77. If two TtRr plants are crossed, what is the chance that one offspring will look like the parents?

A. $\frac{4}{16}$
B. $\frac{8}{16}$
C. $\frac{9}{16}$
D. $\frac{12}{16}$

78. What is the chance of the offspring referred to in question #79 resembling the parents in only ONE of the two traits?

A. $\frac{1}{16}$
B. $\frac{6}{16}$
C. $\frac{7}{16}$
D. $\frac{15}{16}$

79. Which one of the following matings could produce a TtRr tomato plant?

A. ♂ TTRr × ♀ TTrr
B. ♂ TtRR × ♀ TtRR
C. ♂ ttRR × ♀ TTrr
D. ♂ Ttrr × ♀ Ttrr

For questions 80 to 88 inclusive use the following 4 choices:

A — if both statements A and B are true
B — if statement A is true and statement B is false
C — if both statements A and B are true and statement A supports statement B
D — if both statements A and B are false

80. A. A species of saprophyte that is living in an environment where its normal food resources are being exhausted may be able to substitute a different food — one not previously used by this specimen.
B. Mutations occur generally as a response to a need of the species.

81. A. A shortage of oxygen in a muscle leads to the production of lactic acid.
B. A shortage of oxygen in a muscle is responsible for increased stimulation of the vagus nerve.

82. A. When glucose is converted to lactic acid, as in the following equation, relatively small amounts of energy are released.

$$C_6H_2O_6 \xrightarrow{\text{enzymes}} 2C_3H_6O_3 + \text{Energy}$$

B. In this reaction there is no increase in the ratio of oxygen to carbon and hydrogen.

83. A. Certain genes are known to be near each other on the chromosome, while others are farther apart on the chromosome.
B. Crossing-over occurs less frequently between some genes than between others.

84. A. Active transport is energy consuming.
B. Diffusion is energy consuming.

85. A. Glucose absorption relies on phosphorylation.
B. Starch is hydrolysed to glucose.

86. A. Auxins are destroyed by light.
B. Sunflowers follow the sun.

87. A. Breathing rate is regulated by oxygen concentration of the blood.
B. Carbon dioxide can be exhaled only through the nose.

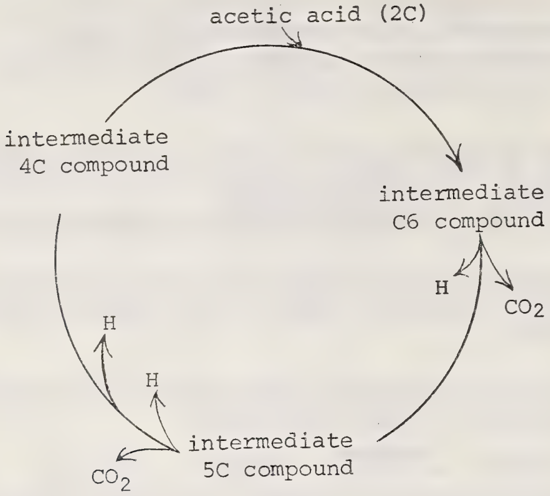
88. A. DPN is an oxygen acceptor.
B. DPN passes the oxygen to the cytochrome system.

---

89. Ovulation occurs when the correct balance is achieved between

A. estrogen and FSH
B. estrogen and LH
C. FSH and progesterone
D. FSH and LH

Use the diagram below to answer questions 90, 91 and 92.



90. What process is represented by the above diagram?

A. fermentation
B. glycolysis
C. carbon dioxide fixation cycle
D. citric acid cycle (Kreb's)

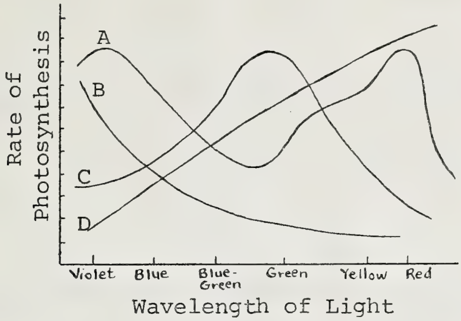
91. The significance of the above reaction is that

A. water and carbon dioxide are produced
B. acetic acid is synthesized
C. ATP molecules are subsequently formed
D. glucose molecules are degraded

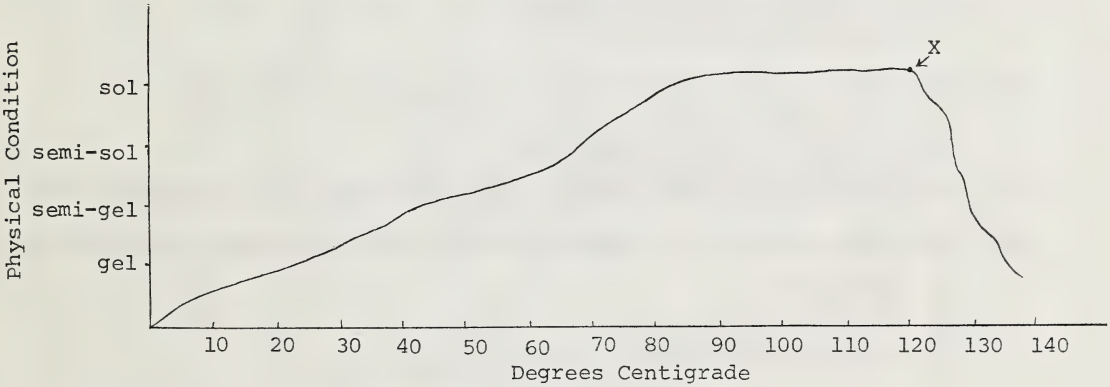
92. This event takes place

A. in the digestive system
B. within mitochondria
C. within ribosomes
D. within the fluid between cells

93. Which one of the lines in the graph below best represents the relationship between wavelength of light and rate of photosynthesis?



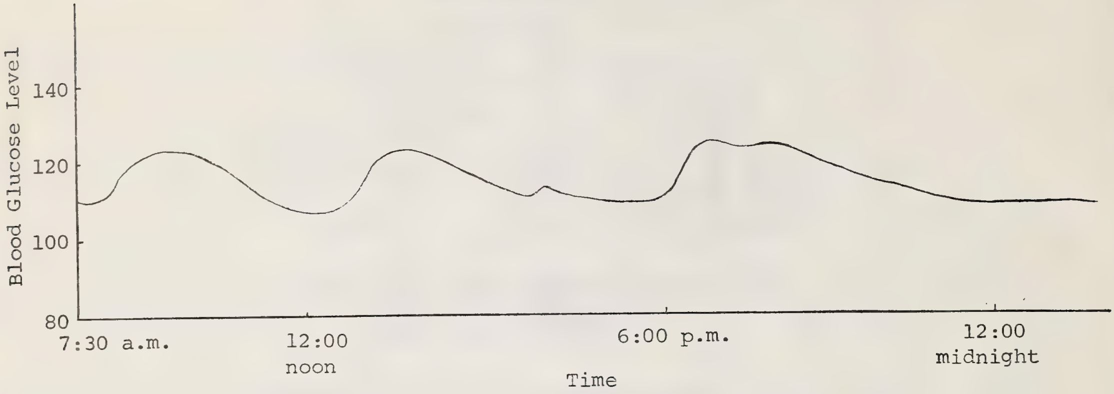
As a test tube of gelatin is heated, records were kept and the following graph was plotted.



94. Which of the following best describes what begins beyond point X?

A. The test tube is coated and the gelatin returns to a solid state.
B. The gelatin is being coagulated.
C. The gelatin can only be a sol for so long, then it automatically turns to a gel.
D. Positive ions have been added which cause the solution to gel.

Use the following graph to answer questions 95, 96, and 97.



95. The fluctuations in the above graph are due to the

A. ingestion of food
B. the activity of the individual
C. conversion of glycogen to glucose
D. absorption of carbohydrates

96. The BEST reason for the glucose level not dropping below 110 is that

A. very little energy is used when sleeping
B. glycogen is converted to glucose
C. the person will eat again at 7:30 a.m.
D. proteins are used as an energy source when the glucose level reaches 110

97. The slight increase in blood glucose level in mid-afternoon suggests that the individual

A. had a snack
B. had a rest
C. worked more strenuously
D. had a drink of water

---

98. In the light of recent discoveries in genetics, the substance changed by X-rays in producing a gene mutation is probably

A. ribonucleic acid
B. deoxyribonucleic acid
C. cytoplasm
D. nucleoprotein

Use the information from the chart below to answer questions 99, 100, and 101.

Composition of Blood Plasma, Capsular Urine and Bladder Urine
(g/100 ml. fluid)

COMPONENT	BLOOD PLASMA	CAPSULAR URINE	BLADDER URINE
Urea	0.03	0.03	2.00
Uric acid	0.004	0.004	0.05
Glucose	0.10	0.10	0.00
Amino acid	0.05	0.05	0.00
Salts	0.72	0.72	1.50
Proteins	8.00	0.00	0.00

99. Which substance is more highly concentrated in the capsular urine than in the bladder urine?

A. urea
B. uric acid
C. glucose
D. salts

100. Which substance is concentrated to the highest degree in going from blood plasma to bladder urine?

A. uric acid
B. urea
C. salts
D. proteins

101. Which component is completely reabsorbed into the blood plasma?

A. amino acids
B. uric acid
C. protein
D. salts

102. If a sample of blood produced clumping in anti-A serum and no clumping with anti-B serum, the type of blood in the sample would be

A. A
B. B
C. AB
D. O

103. Seed plants form

A. spores but not gametes
B. spores of two sizes
C. an independent gametophyte
D. gametes but not spores

104. In a "normal" mammalian eye, the ability to focus an image properly depends upon the

A. presence of sufficient vitamin A
B. action of the ciliary body
C. curvature of the sclera
D. proper balance between rod and cone cells

105. Dynamic balance in a mammal is achieved by

A. the utricle and saccule
B. visual sensations
C. the degree of weightlessness felt
D. the semicircular canals

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